19.
DOES IN VIVO DOSIMETRY IMPROVE QUALITY OF RADIOTHERAPY: EVALUATION OF 1000 PATIENT'S CHECKS

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Radiotherapy is a part of a complex treatment administered to patients with cancer. It uses a radiation which is generated and processed by specialized and sophisticated equipment .

Since the beginning of the 20th century the main idea of radiotherapy remained unchanged. It is based on a proven interaction between radiation and human tissues resulting in their partial or total damage. Over the years more knowledge has been gained, especially on fractionation, doses and the reactions of different tissues and organs. The new sources of radiation have begun to be used, including high energy photon end electron beam accelerators. It became evident that major advance in clinical results might be achieved by limitation of the dose strictly to the target volume (tumour) and by sparing normal tissues.

The issue of critical importance was the execution of the prescribed treatment. When treatment planning with the accuracy expressed in milimmitres became possible it it had to be proved that subsequent treatments would make it possible to assure such accuracy. *In-vivo* dosimetry was believed to be of help in increasing the accuracy in radiotherapy. Since its aim was not to modify the treatment but only to execute it according to a prescribed schedule dosimetry should bring about only benefits when implemented in the routine work

However, being an extensive procedure, dosimetry consumed a lot of effort. In regular work, it is difficult to imagine that each beam could be measured *in-vivo* for each fraction. Measurements at more than one point for one beam were only considered for special and rare procedures such as mantle fields.

In the practice of radiotherapy as carried out at the Greatpoland Cancer Centre routine *in-vivo* dosimetry was started in 1999, first applied to the patient's head and neck, and then extended to all patients. At least two measurements for each patient were made during the whole treatment. Whenever discrepancy occurred, exceeding 10% between the calculated and measured dose, the search for its cause was initiated. The very first problem involving the implementation of our method to the routine, was the number of dosimeters required. Transporting the dosimeter from one unit to another when dosimetry was requested involved a larger error due to the instability of the detecting unit. Another problem was the staff required. At first, physicists took care of dosimetry, but then technologists were trained who are now making the majority of measurements. A protocol from each measurement is included in the patient's record and is shown for approval to the physician.

For the evaluation of our method a group of 1123 patients were analysed: 850 patients with head and neck cancer, 228 with breast cancer and 45 with lung cancer. The number of measurements was at least twice as large because each patient was irradiated from more than one beam.

The mean percent differences between the calculated doses and those measured in-vivo were –1.5 % (Standard Deviation, SD of 7.8) for the head and neck, +3.4% (SD=4.9) for breast, and –2.4% (4.3) for the lungs.

The estimation of the error usinf a total differential method for a single measurement gives the value of more than 10% (upper limit of error). However, the statistical analysis of the measurements on the whole group with nearly a normal distribution provided a more realistic error of about 6%.

Conclusions

In-vivo dosimetry is a standard procedure in conformal radiotherapy. It does not help to avoid casual and even large errors since it is not done for all beams every time. It makes it possible to reduce the mean error in whole group of patients, which in effect should lead to more effective radiotherapy.

20.
SETTING THE PACE FOR STRENGTHENING RADIOTHERAPY IN EUROPE: THE ESTRO ESQUIRE PROJECT.

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In most medical specialties the success rate and outcome of treatment coincide and can be

measured immediately. This is not the case for radiotherapy where debilitating of even lethal side effects may show up as late as 18 years after treatment. To determine the outcome or therapeutic ratio of radiotherapy, it is therefore necessary to link tumour control closely to the actuarial long-term disease free survival of the patient.

The therapeutic window for radiotherapy is narrow. In walking the tightrope between cure and complications, radiotherapy can put the odds at its side. As a precautionary measure, strict quality assurance measures including the monitoring of side effects need to be put in place. Recent studies have demonstrated that every gain in the accuracy of the beam output and treatment delivery is translated into important gains in the uncomplicated cure probability, thus sparing the lives of thousands of patients every year. QA will become all the more mandatory now that new technological developments allow much more precision in the delivery of the intended dose to the intended target volume, thus making an escalation of the dose and hence the improvement of the cancer cure rata possible.

Europe has only half the number of treatment units of America and Japan. However, it has also its own strengths. These are exactly in the field of quality assurance and education. ESTRO has become a world leader in the provision of teaching in the field of radiotherapy. The ESTRO teaching programme commands the admiration and even the envy of the International radiation oncology community. We need to capitalise on this achievement and keep it at the cutting edge of scientific and technological progress to offset, through the development of the human potential and optima) use of capital-intensive infrastructural resources, at least partially the shortage in capital investment and the past shortfall in spending for research.

For this reason ESTRO is embarking on an ambitious new project called ESQUIRE (Education, Science and Quality Assurance In Radiotherapy in Europe) which it hopes to realise with the support of EU funding. The aim of this project is to increase the confidence level of clinicians for embracing optimised RT treatment regimes by making sure they can be introduced without an increase in severe side effects. Actions proposed for this purpose: monitoring the accuracy of the dose (Talk 1:E~UAL) and the side effects (Task 2: REACT), by stepping up education for the implementation of new technology (Task 3: EDRO,) by developing quality assurance procedures for optimised RT (Task 5: QUASIMODO) and brachytherapy (Task 6: BRAPHY~S), and establishing a procedure-based surveillance of quality in treatment and research (Task 4:EPOQART).

21.
THE STRUCTURE AND ACTIVITY OF INTERNATIONAL ORGANISATIONS FOR MEDICAL PHYSICS AND BIOMEDICAL ENGINEERING

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The International Union for Physical and Engineering Sciences in Medicine (IUPESM)comprises a global network of 40,000 graduate physical scientists and engineers in about 100 countries. IUPESM has two constituent organisations, the International Organisation for Medical Physics (IOMP) and the International Federation for Medical and Biological Engineering (EFMBE).

IUPESM has sponsored triennial World Congresses in many countreis since 1967. The Millennium Congress was held in Chicago, USA, with 6500 participants from 70 countries with 4000 oral presentations and posters.

Regional scientific meetings, educational courses and scientific conferences are also. IUPESM, IOMP, IFMBE have interrelated Working Groups such as the Science Committee, Publications Committee and Education and Training Committee

Many journals belong to or are associated with IUPESM through our international and national member societies, as listed on the IUPESM Global Knowledge Network for Medicine, Physics and Bioengineering (http://www.wc 2000.org/).The main area of IUPESM and IOMP activities are:

(1) Education, Training and Continued Professional Development for the 21st Century with particular reference to Developing and Emerging Countries.
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